

Original Article

CD-ROM-based program for breastfeeding mothers

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Abstract

The vast majority of breastfeeding mothers in Western countries have routine access to multimedia and Internet resources at home. The aim of this study was to assess the effectiveness of a CD-ROM-based intervention in increasing the rates of breastfeeding. We conducted a pre- and post-intervention study involving four control and four intervention maternity units in France. All breastfeeding mothers in intervention units were given a CD-ROM-based program addressing various breastfeeding topics. The primary outcome was any breastfeeding at 4 weeks assessed by follow-up telephone interview. The secondary outcomes included breastfeeding duration, breastfeeding difficulties after discharge and satisfaction with the breastfeeding experience. The rates of any breastfeeding at 4 weeks varied from 88.6% (209/236) to 87.9% (211/240) and from 86.0% (222/258) to 88.0% (228/259) for mothers enrolled in intervention and control maternity units, respectively (P for interaction = 0.54). The hazard of breastfeeding discontinuation for mothers enrolled in intervention units did not vary significantly across study periods after adjusting for education level, epidural anaesthesia, breastfeeding assessment score and return to work (P for interaction = 0.18). The rates of breastfeeding at 4 weeks remained unchanged when restricting the analysis to the mothers who actually received (87.8% [173/197]) or used [88.2% (105/119)] the CD-ROM during the post-intervention period. No significant differences were found in secondary outcomes between the two study groups. A CD-ROM-based intervention for breastfeeding mothers provides no additional benefit to usual post-natal care. Further study is needed to assess the effectiveness of multimedia packages as part of more intensive multifaceted interventions.

Keywords: infant and child nutrition, education, breastfeeding duration, prospective study.

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The beta version of the CD-ROM is available upon request to the corresponding author and the final version can be ordered on the web site of the Association Française de Pédiatrie Ambulatoire (<http://www.afpa.org>).

Introduction

The benefits of prolonged breastfeeding for infant health are widely documented (Kramer & Kakuma 2004; Duijts *et al.* 2009). Interventions to promote breastfeeding (Chung *et al.* 2008) have contributed to a steady increase in the rates of breastfeeding

initiation in Western countries (Gartner *et al.* 2005). However, between 10% and 30% of mothers who initiate breastfeeding fail to continue by 2 weeks of infant age (Ertem *et al.* 2001; Taveras *et al.* 2003). Mothers who discontinue breastfeeding prematurely often report a lack of confidence in their ability to breastfeed, inappropriate beliefs regarding infant

preferences and a lack of appropriate guidance and reassurance (Ertem *et al.* 2001; Ahluwalia *et al.* 2005; Li *et al.* 2008a).

Multimedia technologies may constitute widely available resources for providing mothers with information on breastfeeding-related topics as an adjunct to usual post-natal care (Black *et al.* 2001). A previous study conducted in nine maternity units in France found that 79% of breastfeeding mothers (median age, 30 years) had a personal computer with a CD-ROM player at home and 65% had routine access to the Internet (Laborde *et al.* 2007a). Multimedia packages have been used successfully for delivering tailored information to suit a broad range of information needs for various paediatric populations (McPherson *et al.* 2006). Multimedia technologies have the advantage of presenting information in an engaging and interactive manner through the use of animation and video sequences. Moreover, patients can review information as often as necessary at their own pace (McPherson *et al.* 2006).

Only a few studies have assessed the benefits of multimedia technologies for breastfeeding education or support (Cheng *et al.* 2003; Huang *et al.* 2007). Although promising, these studies had limited generalizability because they enrolled selected patients, were conducted at single tertiary care centres or focused on knowledge and attitudes towards breastfeeding rather than breastfeeding duration.

The aim of this study was to assess the effectiveness of a CD-ROM-based intervention for breastfeeding mothers as an adjunct to usual post-natal care in routine practice. We hypothesized that mothers discharged from maternity units providing a CD-ROM-based program had higher rates of breastfeeding at

4 weeks and better breastfeeding-related outcomes than those discharged from control maternity units.

Materials and methods

Study design

We designed a controlled pre- and post-intervention study involving eight maternity units in France. Pre-intervention data were collected from consecutive breastfeeding mothers discharged from participating maternity units during a 1-month period in 2005. To adjust for secular trends and sudden changes (Eccles *et al.* 2003), our study intervention was implemented in four maternity units, while four other maternity units served as controls. Then, data were collected from consecutive breastfeeding mothers discharged from intervention and control maternity units during a 1-month period in 2006.

All enrolled mothers provided informed consent for participation and follow-up. The study protocol was approved by the Ethics Committee of the French Data Protection Agency (Comité Consultatif sur le Traitement de l'Information en Matière de Recherche dans le Domaine de la Santé, Paris, France).

Study sites

Of the participating maternity units, one was located in a university-affiliated hospital, four in general hospitals and three in private hospitals. Control and intervention maternity units were matched on breastfeeding rate at discharge. Hence, median annual numbers of deliveries (1417 vs. 1429) and breastfeeding rates at discharge (68% vs. 68%) were

Key messages

- Multimedia technologies constitute widely available resources for delivering simple and accurate information to breastfeeding mothers in Western countries.
- There is no evidence that a CD-ROM-based program for breastfeeding mothers provides additional benefit in comparison to usual post-natal care.
- Only half of breastfeeding mothers used a CD-ROM based program that was given to them at discharge from the maternity unit.
- Further study is needed to assess the effectiveness of a CD-ROM-based program as part of multifaceted interventions.

comparable for intervention and control maternity units.

Study population

Consecutive mother–infant pairs were assessed for eligibility 7 days a week by a physician in each maternity unit. Mothers were eligible if they had delivered a healthy singleton infant (i.e. gestational age ≥ 37 completed weeks and weight ≥ 2500 g) and were breastfeeding on the day of discharge. Mother–infant pairs were excluded if the infant was admitted to a neonatal unit or if the mother was less than 18 years of age, refused to participate in the study, was unable to speak French or was unlikely to complete follow-up because of psychosocial problems such as homelessness. The lack of routine access to a personal computer with a CD-ROM player or the non-use of the CD-ROM was not an exclusion criterion. Indeed, our study was designed to provide evidence for the effectiveness of our intervention in the real-world setting (Bonuck *et al.* 2009).

CD-ROM-based program

From the First to the Last Breastfeeding is a CD-ROM-based program for breastfeeding mothers developed by a multidisciplinary team including midwives, paediatricians, lactation consultants, behavioural scientists and technologists. The rationale, conceptual development, content and learning objectives of the CD-ROM have been described in detail elsewhere (Poingt-Tremey 2005). Briefly, the CD-ROM was designed to provide accurate and simple information on how to initiate and maintain breastfeeding. The conceptual development of the CD-ROM was based on self-efficacy theory and included four components: a positive evaluation of health benefits associated with prolonged breastfeeding duration; realistic goals regarding intended breastfeeding duration; the development of cognitive and behavioural skills to cope with common breastfeeding problems; and self-monitoring of breastfeeding (Coombs *et al.* 1998). The content of the program was consistent with evidence from published literature and consensus guidelines. All recommendations

were reviewed by an expert panel. The program received the approval from the French Association of Ambulatory Paediatrics (Association Française de Pédiatrie Ambulatoire). The program was pretested for comprehension with professionals and mothers, and modified accordingly. It contained 12 modules, which users could consult in any order. Module 1 summarized the evidence supporting prolonged breastfeeding; module 2 reviewed the physiology of lactation; module 3 provided the mother with practical recommendations for successful breastfeeding; module 4 focused on breastfeeding initiation in the hospital; modules 5–7 addressed common breastfeeding problems and their management; module 8 covered breastfeeding in special circumstances; module 9 was intended for working mothers; module 10 was a Frequently Asked Questions section; module 11 described breastfeeding supplies and accessories; and module 12 gave an overview of resources and initiatives regarding breastfeeding. The program used animation and video sequences to illustrate various topics such as initiation, positioning and latch-on.

Interventions

In control units, breastfeeding education was delivered through a 1-h didactic session during routine antenatal childbirth classes. The attendance rate at prenatal childbirth classes was 21%. Usual verbal encouragement was provided to initiate and maintain breastfeeding during the intrapartum period. At discharge, the infant was examined by the paediatrician working in the unit for a general health assessment and an evaluation for evidence of successful breastfeeding behaviour. The mothers were also provided with the telephone number of a peer support group that they could call to ask questions and request help. Follow-up consisted of routine, preventive, outpatient visits in a primary care physician's office at 1, 2, 3, 4, 5 and 6 months of infant age. The period of paid maternity leave was 10 weeks after the birth, extended to 18 weeks after the birth of the third child (Labarere *et al.* 2005).

In intervention units, mothers were introduced to the CD-ROM during prenatal childbirth classes. In each unit, a personal computer was exclusively dedi-

cated to the use of the program by mothers during the hospital stay. At discharge, all mothers were given a copy of the CD-ROM and were encouraged to use it at home. The CD-ROM was accompanied by a four-page booklet summarizing its content and providing instructions for installation and use. A hotline was available 6 days a week for resolving technical difficulties in installation or use. The CD-ROM was designed as an adjunct to usual post-natal care and was not intended to replace professional support.

Data collection

A midwife or a paediatrician in each maternity unit prospectively collected detailed data on baseline mother and infant characteristics, maternity ward practices, and risk factors that comprised the breastfeeding assessment score (BAS) (Laborde *et al.* 2007b). BAS values range from -6 to 10 (Hall *et al.* 2002). In the original BAS derivation cohort (Hall *et al.* 2002), mothers with a BAS less than 8 were at increased risk for early weaning. To comply with the French Data Agency requirements (Commission Nationale de l'Informatique et des Libertés), we did not collect information on the participants' ethnicity.

Two trained research assistants conducted structured follow-up telephone interviews with mothers at 4 and 26 weeks. They made five attempts on different dates and at different times before deciding that the mother was unreachable. They asked whether the mother was still breastfeeding on the day of the interview or within the previous 24 h. If the mother was no longer breastfeeding, the research assistant asked the age at which the infant was weaned and the reasons for weaning. The research assistant also interviewed mothers about breastfeeding difficulties after discharge and overall satisfaction with the breastfeeding experience rated on a four-point single-item scale.

Outcome measures

Our primary outcome was the prevalence of any breastfeeding at 4 weeks, defined by breastfeeding within 24 h of the 4-week follow-up interview. Consistent with World Health Organization terminology (World Health Organization 2008), breastfeeding

required that the infant received breast milk and included exclusive breastfeeding, predominant breastfeeding and complementary feeding. The secondary outcomes included breastfeeding duration, breastfeeding difficulties after discharge and overall satisfaction with the breastfeeding experience. Breastfeeding duration was defined as the time from birth to breastfeeding discontinuation. As breastfeeding duration was undetermined for mothers who were still breastfeeding at 26 weeks, the time to breastfeeding discontinuation was censored at the date of the last follow-up (i.e. 26 weeks).

Sample size

Based on a previous study (Lelong *et al.* 2000), we assumed a 70% rate of any breastfeeding at 4 weeks during the pre-intervention study period. We calculated that a total of 404 mothers would provide a power of 90% to detect a relative difference of 20% in breastfeeding rates between the pre- and post-intervention study periods (i.e. 70% vs. 84%) at the significance level of 0.05. We anticipated that a minimum of 60 consecutive mothers could be enrolled per maternity unit during a 1-month period.

Statistical analysis

Differences in baseline characteristics between the pre- and post-intervention periods were compared using the χ^2 test or Fisher's exact test where appropriate for categorical variables and the Kruskal-Wallis test for continuous variables. The risk of breastfeeding discontinuation was estimated according to the Kaplan-Meier method. We used Cox proportional hazards models for estimating the hazard ratio of breastfeeding discontinuation and its 95% confidence interval. To account for the study design, the intervention group, study period and a first-order interaction between intervention group and study period were entered in the model. We tested the interaction between intervention group and study period for significance. We hypothesized that the hazard of breastfeeding discontinuation would decrease between the pre- and post-intervention study periods for mothers discharged from intervention maternity

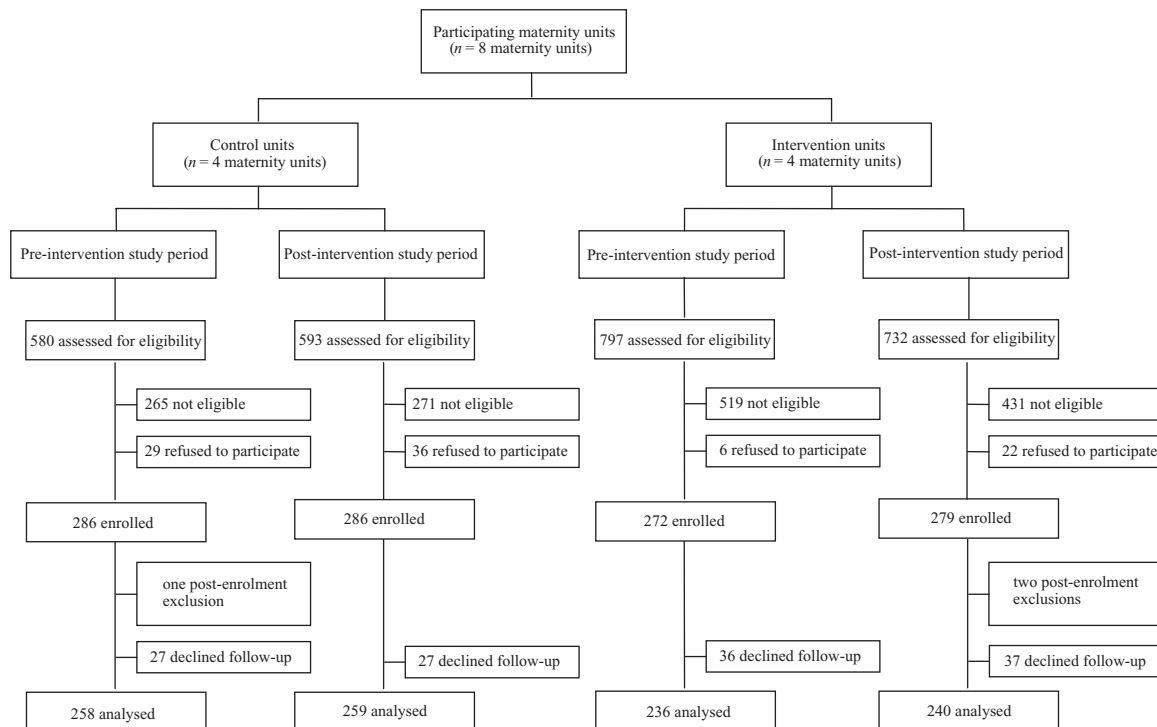


Fig. 1. Mother–infant pair enrolment. The main reasons for ineligibility were not breastfeeding at discharge ($n=1102$), newborn's transfer to neonatal intensive care unit ($n=86$), inability to speak French ($n=66$), birthweight <2500 g ($n=57$), gestational age <37 weeks ($n=56$), multiple pregnancy ($n=33$), mother's transfer to intensive care unit ($n=13$), psychosocial problems incompatible with successful follow-up ($n=11$), mother's age <18 ($n=7$), other or unspecified ($n=55$).

units and would remain unchanged across the two study periods for mothers discharged from control maternity units. In multivariable analysis, we developed a Cox proportional hazards model adjusting for BAS, epidural anaesthesia, education level and return to work. Return to work was introduced using a discrete time-varying covariate.

For binary outcomes, we used logistic regression analysis for modelling odds ratios as a function of the intervention group, study period and a first-order interaction between intervention group and study period. Two-sided P -values of less than 0.05 were considered statistically significant. Analyses were performed using Stata version 9.0 (Stata Corporation, College Station, TX, USA).

Results

A total of 2702 consecutive mother–infant pairs were screened for eligibility during the two study periods.

Of these, 1486 mothers were ineligible, and 93 refused to participate in the study (Fig. 1). Three enrolled mothers were excluded because of the discovery of an exclusion criterion after enrolment, and 127 declined follow-up telephone interviews. Finally, 993 mothers were analysed.

The median age for all mothers was 30 years [Interquartile range (IQR), 27–33], 444 (44.7%) were primiparous and 151 (15.2%) delivered by caesarean section. Of the 858 mothers for whom the BAS could be calculated, 376 (43.8%) had a score lower than 8. The post-intervention period was associated with earlier return to work for mothers enrolled in control and intervention maternity units (Table 1). Of the 240 mothers who were enrolled in the intervention units, 197 (82.1%) actually received the CD-ROM; 119 (49.6%) said they used the CD-ROM at least once; two (0.8%) experienced technical difficulties when using the CD-ROM; 114 (47.5%) stated that they would probably or certainly recommend the CD-ROM to

Table 1. Comparison of mother–infant pair baseline characteristics between the pre- and post-intervention samples

Characteristics*	Control units		<i>P</i>	Intervention units		<i>P</i>
	Pre-intervention sample (<i>n</i> = 258)	Post-intervention sample (<i>n</i> = 259)		Pre-intervention sample (<i>n</i> = 236)	Post-intervention sample (<i>n</i> = 240)	
Age, year, median (IQR)	30 (28–33)	30 (27–33)	0.33	30 (27–33)	30 (27–33)	0.55
Single, <i>n</i> (%)	3 (1.2)	4 (1.6)	0.99	3 (1.3)	6 (2.5)	0.32
Unemployed, <i>n</i> (%)	18 (7.5)	20 (7.9)	0.85	17 (7.4)	15 (6.5)	0.70
High school degree or less, <i>n</i> (%)	62 (24.8)	64 (25.2)	0.90	81 (35.5)	67 (29.3)	0.15
Smoking during pregnancy, <i>n</i> (%)	27 (10.5)	22 (8.5)	0.44	23 (9.8)	31 (13.2)	0.25
Caesarean section, <i>n</i> (%)	38 (14.9)	45 (17.6)	0.40	36 (15.4)	32 (13.4)	0.54
Epidural anaesthesia, <i>n</i> (%)	218 (84.8)	225 (87.5)	0.37	163 (69.7)	154 (66.9)	0.53
Female gender, <i>n</i> (%)	129 (51.0)	118 (46.3)	0.29	121 (51.5)	110 (46.4)	0.27
Birth weight, g, median (IQR)	3320 (3060–3620)	3383 (3090–3650)	0.23	3330 (3100–3620)	3340 (3100–3670)	0.93
Breastfed within 1 h after delivery, <i>n</i> (%)	162 (65.6)	162 (65.8)	0.95	134 (59.8)	154 (68.1)	0.07
Pacifier use, <i>n</i> (%)	80 (31.7)	79 (31.1)	0.88	45 (19.7)	34 (14.8)	0.17
Breastfeeding Assessment Score <8, <i>n</i> (%) [†]	94 (42.0)	104 (46.8)	0.30	94 (44.8)	84 (41.6)	0.51
Time to return to work, wk, median (IQR) [‡]	18 (16–20)	16 (13–18)	0.008	18 (15–22)	14 (12–19)	0.002

IQR, denotes interquartile range. *Values were missing for marital status (*n* = 1), employment status (*n* = 39), education level (*n* = 32), smoking status (*n* = 6), gender (*n* = 13), breastfeeding within 1 h after delivery (*n* = 51), pacifier use (*n* = 30), breastfeeding assessment score (*n* = 135).

[†]The risk factors for early weaning that comprised the breastfeeding assessment score were maternal age, previous breastfeeding experience, latching difficulty, breastfeeding interval, number of bottles of formula before enrolment, previous breast surgery, maternal hypertension during pregnancy and vacuum vaginal delivery (Hall *et al.* 2002). [‡]Time to return to work was estimated for 198 (40.1%) and 185 (37.1%) mothers who returned to work within 6 months of delivery during the pre- and post-intervention study periods, respectively.

Table 2. Comparison of breastfeeding outcomes between the pre- and post-intervention samples

	Control units		<i>P</i>	Intervention units		<i>P</i>
	Pre-intervention sample (<i>n</i> = 258)	Post-intervention sample (<i>n</i> = 259)		Pre-intervention sample (<i>n</i> = 236)	Post-intervention sample (<i>n</i> = 240)	
Any breastfeeding at 4 weeks, <i>n</i> (%)	222 (86.0)	228 (88.0)	0.50	209 (88.6)	211 (87.9)	0.83
Breastfeeding duration, week, median (IQR)*	18 (9–26+)	18 (9–26+)	0.42	19 (12–26+)	16 (9–26+)	0.15
Any breastfeeding difficulties after discharge, <i>n</i> (%) ^{†‡}	159 (61.6)	142 (54.8)	0.12	134 (56.8)	141 (59.0)	0.62
Very/fairly satisfied with breastfeeding experience, <i>n</i> (%) [†]	227 (88.0)	236 (91.1)	0.24	215 (91.1)	216 (90.8)	0.90

IQR, denotes interquartile range. *Reasons for weaning reported by 589 mothers who discontinued breastfeeding by 6 months included return to work (*n* = 170), breastfeeding difficulties (*n* = 91), desire to discontinue (*n* = 84), infant not gaining enough weight (*n* = 69), other (*n* = 170) and unspecified (*n* = 5). [†]Values were missing for breastfeeding difficulties after discharge (*n* = 1) and satisfaction with breastfeeding experience (*n* = 2). [‡]Breastfeeding difficulties after discharge included breast engorgement (*n* = 366), cracked nipples (*n* = 220), sore nipples (*n* = 201) and sucking problems (*n* = 91).

their friends; and 88 (36.7%) stated that they would probably or certainly use the CD-ROM at a future birth.

The rates of any breastfeeding at 4 weeks varied from 88.6% to 87.9% and from 86.0% to 88.0% for mothers enrolled in intervention and control mater-

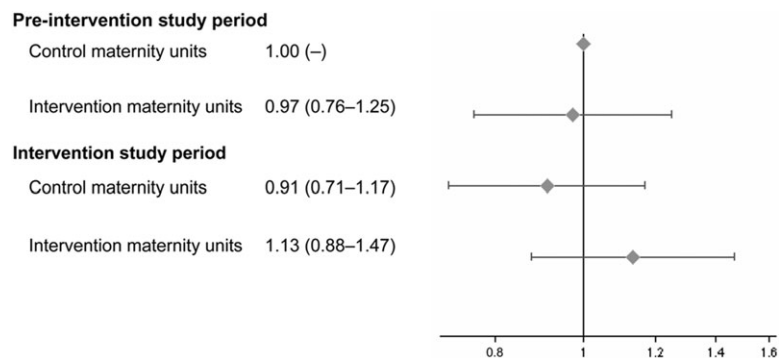
nity units, respectively (Table 2, *P* for interaction = 0.54). No significant interaction was found between maternity unit and study period within the control and intervention groups (Table 3). The rates of any breastfeeding at 4 weeks remained unchanged when restricting the analysis to the mothers who

Table 3. Comparison of 4-week breastfeeding rates across maternity units

	Any breastfeeding at 4 weeks, n/N (%)		<i>P</i> *
	Pre-intervention period	Post-intervention period	
Control maternity units			0.90
Maternity 1	44/50 (88.0)	53/61 (86.9)	
Maternity 2	47/60 (78.3)	45/56 (80.4)	
Maternity 3	66/74 (89.2)	69/74 (93.2)	
Maternity 4	65/74 (87.8)	61/68 (89.7)	
Intervention maternity units			0.38
Maternity 5	47/55 (85.4)	34/43 (79.1)	
Maternity 6	58/68 (85.3)	51/55 (92.7)	
Maternity 7	56/62 (90.3)	66/76 (86.8)	
Maternity 8	48/51 (94.1)	60/66 (90.9)	

**P* for interaction between maternity unit and study period.

Fig. 2. Adjusted hazard ratios (95% confidence interval) of breastfeeding discontinuation (*P* for interaction=0.18). Hazard ratios were estimated using the Cox proportional hazards model adjusting for breastfeeding assessment score <8, return to work, epidural anaesthesia and education level. Return to work was introduced using time-varying covariate. One hundred sixty-one patients were excluded from multivariable analysis because of missing values. (◆) represents point estimates and horizontal lines represent 95% confidence intervals.



actually received [87.8% (173/197)] or used [88.2% (105/119)] the CD-ROM during the intervention study period. No significant differences were found in breastfeeding duration (*P* for interaction = 0.11), breastfeeding difficulties after discharge (*P* for interaction = 0.15) and satisfaction with the breastfeeding experience (*P* for interaction = 0.38) for mothers enrolled in control and intervention maternity units (Table 2).

In multivariable analysis, the hazard of breastfeeding discontinuation for mothers enrolled in intervention units did not vary significantly across study periods (*P* for interaction = 0.18, Fig. 2). Return to work (hazard ratio, 1.46; 95% confidence interval, 1.09–1.96), BAS lower than 8 (hazard ratio, 1.35; 95% confidence interval, 1.13–1.62) and epidural anaesthesia (hazard ratio, 1.34; 95% confidence interval, 1.07–1.70) were independently associated with increased hazards of breastfeeding discontinuation.

Discussion

In this controlled pre- and post-intervention study, a CD-ROM-based intervention for breastfeeding mothers provided no additional benefit to usual post-natal care. To our knowledge, our study was the first to assess the effectiveness of a CD-ROM-based intervention in routine practice.

There are several potential explanations for our negative findings. First, only 49.6% of the mothers enrolled in the intervention units used the CD-ROM. It would have been interesting to elicit the reasons why half of the mothers did not use the CD-ROM, although this was not within the scope of this study. This investigation would have required conducting in-depth qualitative interviews. Importantly, only two mothers (0.8%) reported technical difficulties when using the CD-ROM, and the majority of the users rated the CD-ROM favourably. A recently published

study suggested that breastfeeding mothers were reluctant to use information and communication technologies and preferred face-to-face support (Roberts *et al.* 2009).

Second, as suggested by our multivariable analysis, many factors other than our study intervention may have affected breastfeeding duration, including the mother's baseline characteristics (Hall *et al.* 2002), smoking status, time to return to work (Labarère *et al.* 2003; Cooklin *et al.* 2008), economic and psychosocial factors (Taveras *et al.* 2003; Li *et al.* 2008b), and professional support provided by primary care physicians (Labarère *et al.* 2005). However, we cannot exclude that a CD-ROM-based program, as part of a more intensive multifaceted intervention, may affect breastfeeding outcomes.

Third, the 4-week breastfeeding rate measured during the pre-intervention study period (88%) was much higher than what we anticipated in our sample size calculation (70%). This may be related to the fact that maternity units were self-selected to participate in our study. As a result, our study was likely to be underpowered in detecting differences between the two groups and the effectiveness of our CD-ROM remains unknown for maternity units with lower baseline breastfeeding rates.

Fourth, our CD-ROM-based intervention may have altered other breastfeeding-related outcomes that were not captured in our study. Indeed, the mothers in intervention units who actually used the CD-ROM rated it favourably and stated that they would recommend it to their friends.

Fifth, qualitative research suggests that breastfeeding mothers need individualized support, which is far more complex than increasing education and knowledge of infant feeding (Sheehan *et al.* 2009). Therefore, our CD-ROM should be considered an adjunct to usual post-natal care and does not replace community or professional support.

The limitations of our study deserve mention. First, 127 mothers (11%) declined follow-up interviews. However, the participation rate was not different between the study groups and therefore was unlikely to have affected our results. Second, patient characteristics were different across study groups and might have confounded our results. This was unlikely as the

effect of our study intervention was unchanged after adjusting for imbalances in baseline characteristics in multivariable analysis. Third, our study was not based on random assignment and we cannot exclude differences in unmeasured confounding factors. Fourth, mothers and interviewers could not be blinded to the study group, and we cannot rule out the possibility of observational bias. However, such bias would be expected to favour the CD-ROM group and would not explain our negative findings. Fifth, assessing the prevalence of any breastfeeding at fixed time points may have contributed to underestimating breastfeeding duration as some infants who were breastfeeding irregularly may not have been breastfed within the 24-h recall period. Asking mothers to complete a detailed diary of feeding practices would have provided more accurate estimates of breastfeeding prevalence and duration. Sixth, it would have been interesting to determine whether the use of the CD-ROM altered knowledge and attitudes towards breastfeeding. However, this could not be done because of the lack of a validated French-language questionnaire for assessment of attitudes towards breastfeeding. Seventh, our study was conducted in French maternity units and our findings may not apply to other settings or geographic locations.

The results of this study challenge the effectiveness of multimedia packages for breastfeeding mothers as an adjunct to usual post-natal care. Although rated favourably by mothers, our CD-ROM was actually used by half of them and was not associated with better breastfeeding outcomes. Moreover, the implementation of a CD-ROM or Internet-enabled program may marginalize mothers who do not have access to a personal computer and who are at a higher risk for early weaning. Further study is warranted to assess the effectiveness of multimedia packages as part of multifaceted intervention designed to support breastfeeding mothers.

Acknowledgements

The following persons were responsible for facilitating the conduct of the study at the local hospital level: Isabelle Gothie (Clinique Belledonne, Saint-Martin d'Hères); Catherine Devoldere (General Hospital,

Abbeville); Catherine Salinier (Maison de Santé Protestante Bordeaux Bagatelle, Talence); Florence Roche and Guy Putet (Hospices Civils, Lyon); Muriel Plasse (General Hospital, Albertville), François-Marie Caron (Clinique Sainte-Claire, Amiens); Jean-Pierre Gout (General Hospital, Voiron); Martine Berchotteau and François Vie Le Sage (General Hospital, Aix-les-Bains).

Ms Fanny Baudino and Maeva Durand conducted follow-up telephone interviews. Ms Linda Northrup, English Solutions (Voiron, France), provided assistance in preparing and editing the manuscript.

Source of funding

This study was supported by grants from the French Ministry of Health (Programme National Nutrition Santé), Grenoble University Hospital (Direction de la Recherche Clinique), and Association Française de Pédiatrie Ambulatoire.

Conflicts of interest

The authors declare that they have no conflicts of interest.

References

- Ahluwalia I.B., Morrow B. & Hsia J. (2005) Why do women stop breastfeeding? Findings from the pregnancy risk assessment and monitoring system. *Pediatrics* **116**, 1408–1412.
- Black M.M., Siegel E.H., Abel Y. & Bentley M.E. (2001) Home and videotape intervention delays early complementary feeding among adolescent mothers. *Pediatrics* **107**, E67.
- Bonuck K.A., Lischewski J. & Brittner M. (2009) Clinical translational research hits the road: RCT of breastfeeding promotion interventions in routine prenatal care. *Contemporary Clinical Trials* **30**, 419–426.
- Cheng W.C., Thompson C.B., Smith J.A., Pugh L. & Stanley C. (2003) A web-based breastfeeding education program. *The Journal of Perinatal Education* **12**, 29–41.
- Chung M., Raman G., Trikalinos T., Lau J. & Ip S. (2008) Interventions in primary care to promote breastfeeding: an evidence review for the U.S. Preventive Services Task Force. *Annals of Internal Medicine* **149**, 565–582.
- Cooklin A.R., Donath S.M. & Amir L.H. (2008) Maternal employment and breastfeeding: results from the longitudinal study of Australian children. *Acta Paediatrica* **97**, 620–623.
- Coombs D.W., Reynolds K., Joyner G. & Blankson M. (1998) A self-help program to increase breastfeeding among low-income women. *Journal of Nutrition Education* **30**, 203–209.
- Duijts L., Ramadhani M.K. & Moll H.A. (2009) Breastfeeding protects against infectious diseases during infancy in industrialized countries. A systematic review. *Maternal and Child Nutrition* **5**, 199–210.
- Eccles M., Grimshaw J., Campbell M. & Ramsay C. (2003) Research designs for studies evaluating the effectiveness of change and improvement strategies. *Quality and Safety in Health Care* **12**, 47–52.
- Ertem I.O., Votto N. & Leventhal J.M. (2001) The timing and predictors of the early termination of breastfeeding. *Pediatrics* **107**, 543–548.
- Gartner L.M., Morton J., Lawrence R.A., Naylor A.J., O'Hare D., Schanler R.J. *et al.* (2005) Breastfeeding and the use of human milk. *Pediatrics* **115**, 496–506.
- Hall R.T., Mercer A.M., Teasley S.L., McPherson D.M., Simon S.D., Santos S.R. *et al.* (2002) A breast-feeding assessment score to evaluate the risk for cessation of breast-feeding by 7 to 10 days of age. *The Journal of Pediatrics* **141**, 659–664.
- Huang M.Z., Kuo S.C., Avery M.D., Chen W., Lin K.C. & Gau M.L. (2007) Evaluating effects of a prenatal web-based breastfeeding education programme in Taiwan. *Journal of Clinical Nursing* **16**, 1571–1579.
- Kramer M.S. & Kakuma R. (2004) The optimal duration of exclusive breastfeeding: a systematic review. *Advances in Experimental Medicine and Biology* **554**, 63–77.
- Labarere J., Bellin V., Fourny M., Gagnaire J.C., Francois P. & Pons J.C. (2003) Assessment of a structured in-hospital educational intervention addressing breastfeeding: a prospective randomised open trial. *BJOG* **110**, 847–852.
- Labarere J., Gelbert-Baudino N., Ayral A.S., Duc C., Berchotteau M., Bouchon N. *et al.* (2005) Efficacy of breastfeeding support provided by trained clinicians during an early, routine, preventive visit: a prospective, randomized, open trial of 226 mother-infant pairs. *Pediatrics* **115**, e139–e146.
- Laborde L., Gelbert-Baudino N., Fulcheri J., Schelstraete C., Francois P. & Labarere J. (2007a) Breastfeeding outcomes for mothers with and without home access to e-technologies. *Acta Paediatrica* **96**, 1071–1075.
- Laborde L., Fulcheri J., Gelbert-Baudino N., Schelstraete C., Mathieu M., Durand M. *et al.* (2007b) Performance of the breastfeeding assessment score for the prediction

- of early weaning in France. *Archives de Pédiatrie* **14**, 978–984.
- Lelong N., Saurel-Cubizolles M.J., Bouvier-Colle M.H. & Kaminski M. (2000) Duration of maternal breastfeeding in France. *Archives de Pédiatrie* **7**, 571–572.
- Li R., Fein S.B., Chen J. & Grummer-Strawn L.M. (2008a) Why mothers stop breastfeeding: mothers' self-reported reasons for stopping during the first year. *Pediatrics* **122**, S69–S76.
- Li J., Kendall G.E., Henderson S., Downie J., Landsborough L. & Oddy W.H. (2008b) Maternal psychosocial well-being in pregnancy and breastfeeding duration. *Acta Paediatrica* **97**, 221–225.
- McPherson A.C., Glazebrook C., Forster D., James C. & Smyth A. (2006) A randomized, controlled trial of an interactive educational computer package for children with asthma. *Pediatrics* **117**, 1046–1054.
- Poingt-Tremey L. (2005) *Development of the CD-ROM Entitled 'From the First to the Last Breastfeeding.'* Université Joseph Fourier: Grenoble (in French).
- Roberts A., Hoddinott P., Heaney D. & Bryers H. (2009) The use of video support for infant feeding after hospital discharge: a study in remote and rural Scotland. *Maternal and Child Nutrition* **5**, 347–357.
- Sheehan A., Schmied V. & Barclay L. (2009) Women's experiences of infant feeding support in the first 6 weeks post-birth. *Maternal and Child Nutrition* **5**, 138–150.
- Taveras E.M., Capra A.M., Braveman P.A., Jensvold N.G., Escobar G.J. & Lieu T.A. (2003) Clinician support and psychosocial risk factors associated with breastfeeding discontinuation. *Pediatrics* **112**, 108–115.
- World Health Organization (2008) *Indicators for Assessing Infant and Young Child Feeding Practices. Part I – Definitions.* World Health Organization: Geneva.